Monazite standards for $\delta^{18}O$ analysis by SIMS

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Monazite is a common accessory mineral often used for U-Th-Pb dating of processes occurring in metamorphic and igneous rocks. Monazite growth can be due to fluid-rock interaction, offering the potential of tracking and dating fluid flow with SIMS in a single mineral or even in a growth zone. Standards are widely available for SIMS dating, but they are rare for accurate oxygen isotope ratio determination ([1] and [2]). This scarcity of standards is problematic, because it is known that $\delta^{18}O$ analysis by ion microprobe is strongly affected by composition dependent instrumental mass fractionation (IMF). Here we show that IMF varies by 2 ‰ $\delta^{18}O$ as a function of monazite compositions. Three new monazite standards were developed for SIMS analysis in the ternary composition space defined by the endmembers monazite ($YREEPO_4$, Mnz), cheralite ($CaTh(PO_4)_2$, Chr) and huttonite ($ThSiO_4$, Hut). Several monazites have been tested and we could retain three, which are suitably homogenous with $Mnz_{0.99}$, $Mnz_{0.88}Hut_{0.09}Chr_{0.03}$ and $Mnz_{0.82}Hut_{0.09}Chr_{0.08}$. Their homogeneity in $\delta^{18}O$ has been confirmed by SIMS analyses and their true preliminary value, measured by laser fluorination, ranges between 8.5‰ and 10.5‰. In addition we used the Moacyr and USGS-44069 monazites already characterized in [2]. IMF is inversely correlated to the $YREEPO_4$ content of monazite only. This result is disagree with [1] which suggests that IMF is dependent on the Th content only.

[1] Breecker and Sharp (2007), *American Mineralogist* **92**, 1561-1572. [2] Rubatto, Putlitz, Gauthiez-Putallaz, Crépisson, Buick, Zheng (2014), *Chemical Geology* **380**, 84-96.